

'Janus' dual-atom catalyst shows enhanced performance for electrocatalytic oxygen reduction and evolution

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Synthetic scheme and morphological characterization of the FeCo–N₃O₃@C catalyst. Credit: *Nature Synthesis* (2024). DOI: 10.1038/s44160-024-00545-1

A research team led by Prof. Yan Wensheng from the University of



Science and Technology of China (USTC) has created the innovative "Janus" dual-atom catalyst (FeCo-N3O3@C) with Fe and Co atoms coordinated synergistically through an N-O bridge, which has showed exceptional performance in both oxygen reduction reaction (ORR) and oxygen evolution reaction (OER). The study was <u>published</u> in *Nature Synthesis*.

Bimetal active-center adjacent atomically dispersed diatomic catalysts have unique geometric and electronic structures, exhibiting higher catalytic activity and selectivity than single-atom catalysts. However, the local coordination structure analysis and multifunctional catalysis of heteronuclear diatomic catalysts are challenging.

The team developed a "double-faced deity" <u>catalyst</u> with different ligands at the Fe-Co heterobimetallic site. They confirmed that the Fe and Co atoms were synergistically coordinated with N atoms and O atoms respectively through N-O bridging with the help of spectroscopic techniques and multiple scattering theoretical calculations.

Electrochemical tests showed that this catalyst exhibited exceptional performance in both ORR and OER, surpassing the commercial $Pt/C+RuO_2$ combination.

Researchers further revealed that the key to its high catalytic activity lay in the strong electronic interaction between Fe-N₃ and Co-O₃ units. Further analysis clarified that the strong electronic coupling effect altered the electron density of the Fe and Co atoms' d-orbitals. It optimized the <u>adsorption</u> and desorption processes of intermediates, thereby accelerating the reaction kinetics of ORR and OER.

This work offers novel perspectives on the <u>rational design</u> and structural characterization of high-performing novel dual-atom catalysts.



More information: Bing Tang et al, A Janus dual-atom catalyst for electrocatalytic oxygen reduction and evolution, *Nature Synthesis* (2024). DOI: 10.1038/s44160-024-00545-1

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